



ACE Examinations

Student Name: _____

2011
YEAR 12
YEARLY EXAMINATION

General Mathematics

General Instructions

- Reading time - 5 minutes
- Working time - 2.5 hours
- Write using black or blue pen
- Calculators may be used
- Draw diagrams using pencil
- A formula sheet is provided at the back of this paper

Total marks – 100

Section I

22 marks

- Attempt Questions 1-22
- Allow about 30 minutes for this section

Section II

78 marks

- Attempt Questions 23-28
- Allow about 2 hours for this section

Section I

22 marks

Attempt Questions 1 - 22

Allow about 30 minutes for this section

Use the multiple-choice answer sheet for Questions 1-22

1 Which expression is equivalent to $3a^2(a+2) - a^2$?

- (A) $3a^3 - a^2 + 2$
- (B) $3a^3 + 5a^2$
- (C) $a^3 + 5a^2$
- (D) $6a^3 - a^2$

2 The table shows personal income tax rates.

<i>Taxable income</i>	<i>Tax payable</i>
0 - \$6000	Nil
\$6001 - \$37 000	Nil + 15 cents for each \$1 over \$6000
\$37 001 - \$80 000	\$4 650 + 30 cents for each \$1 over \$37 000
\$80 001 - \$180 000	\$17 550 + 37 cents for each \$1 over \$80 000
\$180 001 and over	\$54 550 + 45 cents for each \$1 over \$180 000

Ben has a gross income of \$81,500 and deductions that total \$2500. Which of the following expressions represents his total tax payable?

- (A) $\$17\,550 + 1000 \times 0.37$
- (B) $\$17\,550 + 1500 \times 0.37$
- (C) $\$4\,650 + 42\,000 \times 0.30$
- (D) $\$4\,650 + 2\,500 \times 0.30$

3 The circumference of a bicycle wheel is 220 cm. How many revolutions will the wheel make if it travels a distance of 6.6 km?

- (A) 30
- (B) 33.3
- (C) 300
- (D) 3000

- 4 The scores on a class test are displayed in the double stem-and-leaf plot opposite. What is the difference in the medians between the scores in the class test for the boys and girls?

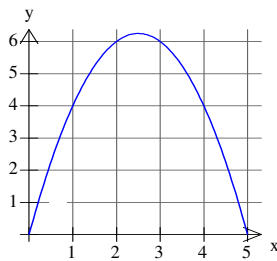
Boys		Girls
6	0	9
6521	1	337
987521	2	0266899
2100	3	2335

- (A) 0
(B) 1
(C) 2
(D) 3
- 5 The table shows the amount George spent on a weekend holiday. He would like to display this information as a sector graph. What size angle is needed to represent entertainment?

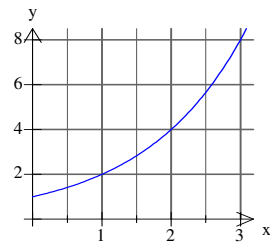
Weekend away	Amount
Motel	\$400
Food	\$96
Entertainment	\$144
Shopping	\$80

- (A) 40°
(B) 36°
(C) 72°
(D) 144°
- 6 Which graph best represents $y = 2^x$?

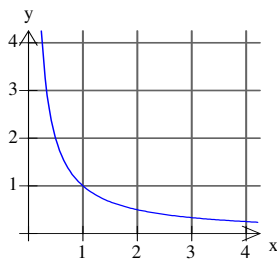
(A)



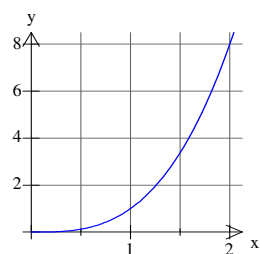
(B)



(C)



(D)



- 7 The rating of local doctors on personal service by their patients was given as high, medium or low. When analysing this data, which of the following could be found?

(A) Mean
(B) Median
(C) Mode
(D) Range

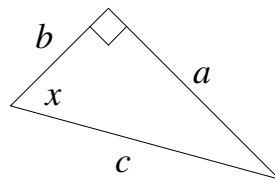
- 8 What is the value of $\sin x$ in the triangle below?

(A) $\frac{b}{c}$

(B) $\frac{a}{b}$

(C) $\frac{b}{a}$

(D) $\frac{a}{c}$



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- 9 Lara earns a total of \$465 for a week's casual work at the general store. She works 20 hours at normal rates and an additional 8 hours at time-and-a-half rate. What is Lara's normal hourly rate of pay to the nearest cent?

(A) \$12.43
(B) \$14.09
(C) \$14.53
(D) \$16.61

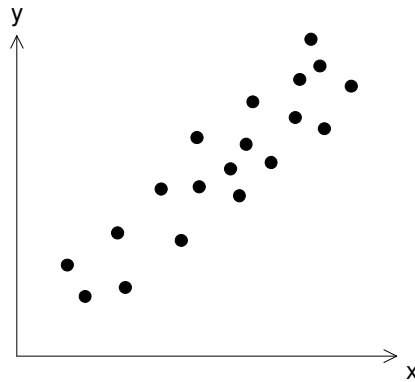
- 10 What is the radius of a sphere if the volume of the sphere is 360 cm^3 ? Answer correct one decimal place.

(A) 1.7 cm
(B) 4.4 cm
(C) 8.1 cm
(D) 9.3 cm

- 11 The amount of money in a fund is given by $A = 800(1.1^t)$ where A is the amount of money and t is the time in years. What is the initial amount of money invested in the fund?

(A) \$800
(B) \$880
(C) \$1000
(D) \$1100

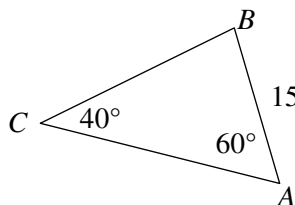
12 How would you describe the relationship between X and Y in the scatterplot below?



- (A) A high positive correlation
 (B) A low positive correlation
 (C) A low negative correlation
 (D) A zero correlation
- 13** In a normally distributed set of scores, the mean is 70 and the standard deviation is 6. Approximately what percentage of the scores will lie between 58 and 82?
- (A) 34%
 (B) 68%
 (C) 95%
 (D) 99.7%
- 14** Alana chooses two chocolates from a box containing 7 different types of chocolates. How many different possible choices could Alana make?
- (A) 2
 (B) 14
 (C) 42
 (D) 49

15 What is the correct expression for AC in triangle ABC ?

- (A) $\frac{15 \sin 80^\circ}{\sin 40^\circ}$
 (B) $\frac{15 \sin 80^\circ}{\sin 60^\circ}$
 (C) $\frac{15 \sin 40^\circ}{\sin 60^\circ}$
 (D) $\frac{\sin 40^\circ}{15 \sin 80^\circ}$

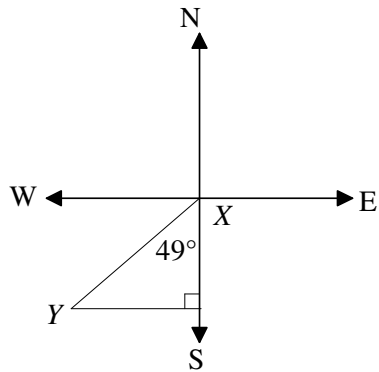


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16 What is the gradient of a line given by the equation $y = 2x - 4$?

- (A) ☐ 4
- (B) ☐ 2
- (C) 2
- (D) 4

17 The compass bearing of Y from X is $S49^\circ W$.



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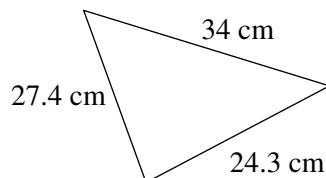
What is the compass bearing of X from Y ?

- (A) $S49^\circ W$
- (B) $S41^\circ W$
- (C) $N49^\circ E$
- (D) $N41^\circ E$

18 Edward stated: 'Winning a prize in Lotto next week is very unlikely.' Which of the following best represents the probability of winning a prize in Lotto?

- (A) 0%
- (B) 1%
- (C) 10%
- (D) 100%

19 The smallest angle in the triangle below is θ .



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What is the value of θ to the nearest degree?

- (A) 30°
- (B) 45°
- (C) 53°
- (D) 82°

Section II

78 marks

Attempt Questions 23 □ 28

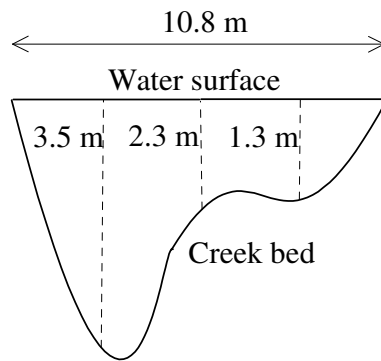
Allow about 2 hours for this section

Answer each question in the appropriate writing booklet.

All necessary working should be shown in every question.

Question 23 (13 marks)	Marks
(a) A two-digit number is formed using the digits 3, 4 and 5. The same number cannot be used twice. The first digit chosen is the tens digit and the second digit chosen is the units digit.	
(i) Construct a tree diagram and list the sample space.	2
(ii) What is the probability that the number formed is 44?	1
(iii) What is the probability that the number formed is 45?	1
(iv) What is the probability that the number formed is greater than 50?	1
(b) Peter an apprentice electrician in his second year.	
(i) Peter purchased tools for \$470. After 2 years it had depreciated to \$235 using the straight-line method. What is the annual amount of depreciation?	1
(ii) What is the percentage rate of depreciation after one year?	1
(iii) Peter earns \$1250 per fortnight. What is Peter's gross annual income?	1
(iv) What is Peter's taxable income for this year if the only allowable tax deduction is the amount of depreciation of his tools in the second year of use?	1
(v) Medicare is calculated at 1.5% of the taxable income. How much is Peter's Medicare levy? Answer to the nearest cent.	1

- (c) The diagram shows a vertical cross-section of a creek.

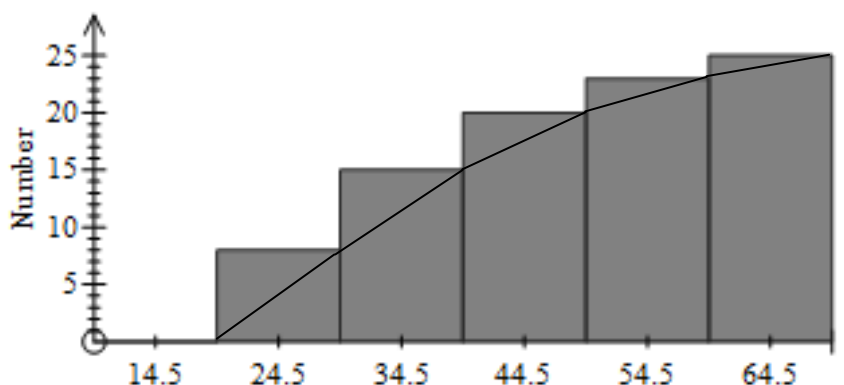


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| (i) | Use Simpson's Rule twice to find an approximation for the area of the cross-section. Answer correct to one decimal place. | 2 |
| (ii) | Assume a 50 metre length of this creek has approximately the same cross-section as above. Estimate the volume of water in this length of creek. Answer to the nearest cubic metre. | 1 |

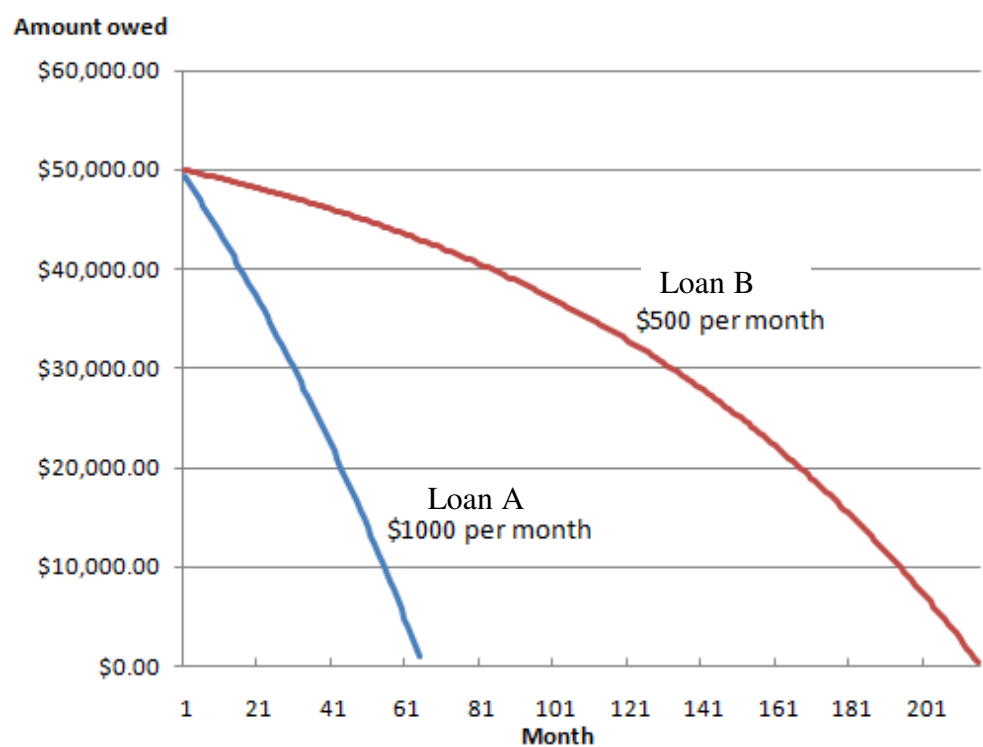
Question 24 (13 marks)**Marks**

- (a) Kate recorded the chocolates sold of a random sample of students. The cumulative frequency graph displays the results with the class centre on the horizontal axis.



- | | |
|--|----------|
| (i) How many students were surveyed? | 1 |
| (ii) How many of the students surveyed were in the 44.5 class? | 1 |
| (iii) Estimate the median of the students surveyed. | 1 |
-
- (b) A traffic roundabout has a circular garden in the centre and two lanes for traffic encircling the garden. The diameter of the garden is 16 metres and each lane is 3 metres wide.
- | | |
|---|----------|
| (i) What is the area of the garden? Answer in square metres correct to 3 significant figures. | 1 |
| (ii) Each lane is to be resurfaced. Calculate the area to be resurfaced. Answer in square metres to the nearest whole number. | 1 |
-
- (c) A raffle ticket can be bought for \$5 each. There are 100 tickets in the raffle.
- First prize is \$250 (1 ticket)
 Second prize is \$25 (5 tickets)
 Mystery prize (1 ticket)
- How much is the mystery prize for the raffle to be fair?
- | | |
|--|----------|
| | 2 |
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- (d) The graph below shows the amount owed each month on two reducing balance loans.



Use the graph to estimate the answer to each question.

- | | | |
|---|--|----------|
| (i) | How much was borrowed? | 1 |
| (ii) | When is the amount owing \$40 000 for loan B? | 1 |
| (iii) | When is loan A paid? | 1 |
| (iv) | Calculate the amount of interest paid on loan A. | 1 |
| (e) Solve the equation $3(a - 2) = 5 - a$ | | 2 |

Question 25 (13 marks)**Marks**

- (a) A delivery truck is purchased by a local council for \$120 000. It depreciates at 16% p.a.

- | | |
|--|----------|
| (i) Calculate the value of the delivery truck after 3 years using the declining balance formula. Answer correct to 2 decimal places. | 2 |
| (ii) What is the percentage loss in value of the delivery truck after 3 years? Answer correct to the nearest whole number. | 1 |

- (b) Motor vehicle number plates consist of three letters followed by three digits.

- | | |
|--|----------|
| (i) How many different number plates are possible? | 1 |
| (ii) What is the probability that the number plate will be BON007? | 1 |
| (iii) What is the probability of the number plate ending with 007? | 1 |

- (c) The results of driving tests are recorded in the two-way table below.

	Female	Male	
Passed on first attempt	50	60	
Passed on later attempt	25	20	

- | | |
|---|----------|
| (i) How many people took the driving tests? | 1 |
| (ii) What percentage of males passed their driving test on the first attempt? | 1 |
| (iii) What fraction of the driving tests for females was passed on a later attempt? | 1 |
| (iv) What is the probability that a person selected at random is male and passed their driving test on a later attempt? | 1 |

- (d) The table shows the present value of a \$1 annuity.

Present value of \$1						
Period	1%	2%	4%	6%	8%	10%
1	0.9901	0.9804	0.9615	0.9434	0.9259	0.9091
2	1.9704	1.9416	1.8861	1.8334	1.7833	1.7355
3	2.9410	2.8839	2.7751	2.6730	2.5771	2.4869
4	3.9020	3.8077	3.6299	3.4651	3.3121	3.1699
5	4.8534	4.7135	4.4518	4.2124	3.9927	3.7908
6	5.7955	5.6014	5.2421	4.9173	4.6229	4.3553

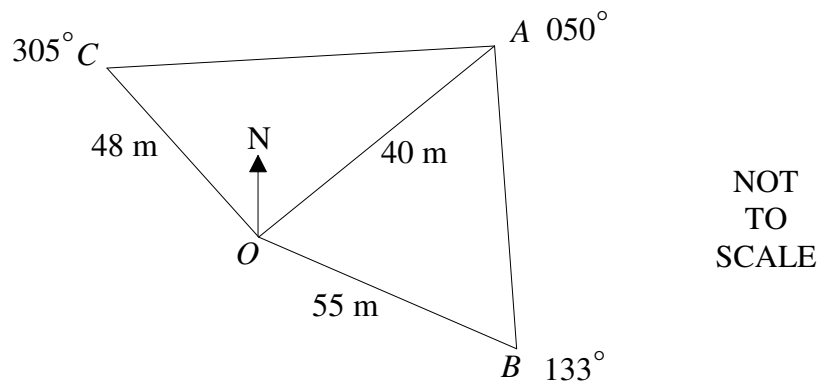
- (i) What would be the present value of an \$11 000 per year annuity at 10% per annum for 5 years, with interest compounding annually? **1**
- (ii) An annuity of \$8000 each three months is invested at 4% per annum, compounded quarterly for 1 year. What is the present value of the annuity? **1**
- (iii) What is the value of an annuity that would provide a present value of \$47 934 after 3 years at 8% per annum compound interest? Answer to the nearest dollar. **1**

Question 26 (13 marks)**Marks**

- (a) The distance to the horizon, d kilometres, is given by the formula $d = 5\sqrt{\frac{h}{2}}$, where h is the height above sea level in metres.

- | | | |
|-------|---|----------|
| (i) | Find d when the height above sea level is 18.5 metres. Answer correct to one decimal place. | 1 |
| (ii) | Rearrange the equation $d = 5\sqrt{\frac{h}{2}}$ to make h the subject. | 1 |
| (iii) | Find h when the distance to the horizon is 8 kilometres. | 1 |

- (b) The following notebook entry was made during a radial survey of a field.

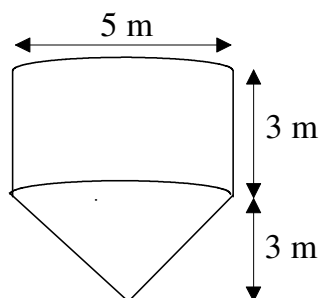


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|-------|--|----------|
| (i) | What is the size of $\angle AOB$? | 1 |
| (ii) | What is the size of $\angle AOC$? | 1 |
| (iii) | Calculate the length of AB correct to two decimal places. | 2 |
| (iv) | Calculate the area of triangle AOB . Answer correct to the nearest square metre. | 1 |

- (c) Coffs Harbour in New South Wales is located at $(30^{\circ}\text{S}, 153^{\circ}\text{E})$ and Springbok in South Africa is located at $(30^{\circ}\text{S}, 18^{\circ}\text{E})$.

- (i) What is the time difference between these places? **1**
- (ii) What is the time in Springbok if it is 3 p.m. at Coffs Harbour? (Ignore time zones). **1**

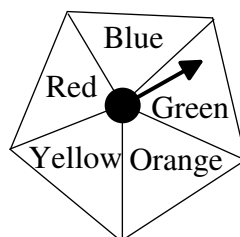
- (d) A grain silo is the shape of a cylinder with a cone at the bottom. It has the dimensions as shown in the diagram.



- (i) What is the volume of the cylinder? Express your answer correct one decimal place. **1**
- (ii) What is the volume of the cone? Express your answer correct one decimal place. **1**
- (iii) What is the volume of the silo? Express your answer correct one decimal place. **1**

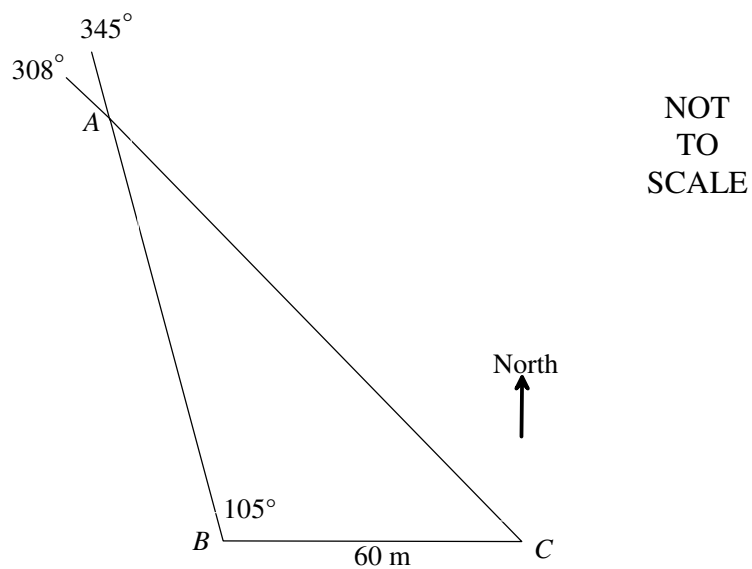
Question 27 (13 marks)**Marks**

- (a) The arrow on a regular pentagon is spun twice. The result is recorded as a blue, green, orange, yellow or a red. Behind two of the colours there is a prize of \$500.



- | | | |
|-------|---|----------|
| (i) | What is the probability of winning \$500 with the first spin? | 1 |
| (ii) | What is the probability of not winning \$500 on the first spin but winning \$500 on the second spin? | 1 |
| (iii) | What is the probability not winning \$500 on both spins? | 1 |
| (iv) | What is the probability of winning at least \$500 on both spins? | 1 |
| | | |
| (b) | The number of people (N) who attend a show varies inversely with the amount of floor space (in cm^2) allowed per person (A). A venue can hold 4800 people if each person is allowed 200 cm^2 . | |
| (i) | How many people could the venue hold if a person was allowed 240 cm^2 ? | 2 |
| (ii) | What is the space allowed per person for 5000 to attend the show? | 1 |
| | | |
| (c) | The manager of a small business has decided to expand the business in 5 years time. To achieve this expansion she has decided to invest \$1200 at the end of each month into an account paying interest at a rate of 9% p.a. compounded monthly for the next 5 years. | |
| (i) | What will be the value of this investment at the end of 5 years?
Answer correct to the nearest cent. | 2 |
| (ii) | Calculate the interest earned on this investment over the 5 year period. Answer correct to the nearest cent. | 1 |

- (d) ABC represents a triangular area of land. The bearing of A from B is 345° and the bearing of A from C is 308° . The distance BC is 60 m and the distance $\angle ABC$ is 105°



- | | | |
|------|--|----------|
| (i) | Find the angle ACB | 1 |
| (ii) | What is the length of AC correct to one decimal place? | 2 |

Question 28 (13 marks)**Marks**

- (a) The number of staff employed in eight stores for company X and company Y is listed below.

Company X	45	252	20	36	95	145	30	75
Company Y	64	115	56	63	82	73	90	74

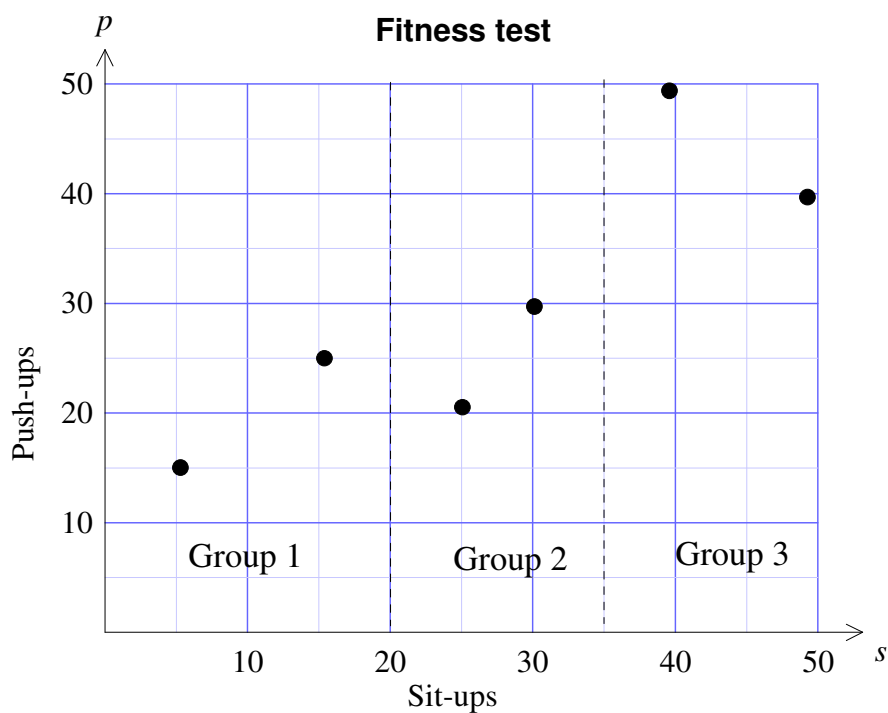
- (i) Find the range and interquartile range for each set of data. **1**
- (ii) Find the mean and median for each set of data. **1**
- (iii) Which is the better measure for the centre of this data? Explain your answer. **1**
- (iv) Compare and contrast the two sets of data. **1**
- (b) The table below shows the approximate coordinates for two Pacific islands.

Pacific Island	Latitude	Longitude
Vanuatu	16°S	167°E
Nauru	1°S	167°E

A yacht leaves Vanuatu at 7.00 am on Monday 12 October and sails due north to Nauru.

- (i) What is the shortest distance between Vanuatu and Nauru? Answer to the nearest nautical mile. **2**
- (ii) The yacht sails at an average speed of 9 knots. How many hours will it take to sail from Vanuatu to Nauru? **1**
- (iii) What is date and time of arrival of the yacht in Nauru? **1**

- (c) The scatterplot shows the number of sit-ups (s) and the number of push-ups (p) performed by six students during a fitness test.



- | | | |
|-------|---|----------|
| (i) | Estimate the correlative coefficient for this data. | 1 |
| (ii) | The data points are divided into three groups. What is the median of each group? | 1 |
| (iii) | Draw a median regression line. What is the equation of the median regression line? | 2 |
| (iv) | Isaac was absent for the push-up test. Predict his push-up result if he scored 36 on the sit-up test. | 1 |

End of paper

FORMULA SHEET

Area of an annulus

$$A = \pi(R^2 - r^2)$$

R – radius of the outer circle

r – radius of the inner circle

Area of an ellipse

$$A = \pi ab$$

a – length of the semi-major axis

b – length of the semi-minor axis

Area of a sector

$$A = \frac{\theta}{360} \pi r^2$$

θ – number of degrees in central angle

Arc length of a circle

$$l = \frac{\theta}{360} \times 2\pi r$$

θ – number of degrees in central angle

Simpson's rule for area approximation

$$A = \frac{h}{3} (d_f + 4d_m + d_l)$$

h – distance between successive measurements

d_f – first measurement

d_m – middle measurement

d_l – last measurement

Surface area

Sphere $A = 4\pi r^2$

Closed cylinder $A = 2\pi rh + 2\pi r^2$

r – radius

h – perpendicular height

Volume

Cone $V = \frac{1}{3} \pi r^2 h$

Cylinder $V = \pi r^2 h$

Pyramid $V = \frac{1}{3} Ah$

Sphere $V = \frac{4}{3} \pi r^3$

r – radius

h – perpendicular height

A – area of base

Sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Area of triangle

$$A = \frac{1}{2} a b \sin C$$

Cosine rule

$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

FORMULA SHEET

Simple interest

$$I = Prn$$

P – initial quantity

r – percentage interest rate per period,
expressed as a decimal

n – number of periods

Compound interest

$$A = P(1 + r)^n$$

A – final balance

P – initial quantity

n – number of compounding periods

r – percentage interest rate per compounding
period, expressed as a decimal

Future value (A) of an annuity

$$A = M \left[\frac{(1 + r)^n - 1}{r} \right]$$

M – contribution per period, paid at the end
of the period

Present value (N) of an annuity

$$N = M \left[\frac{(1 + r)^n - 1}{r(1 + r)^n} \right] \text{ or } N = \frac{A}{(1 + r)^n}$$

Straight-line formula for depreciation

$$S = V_0 - Dn$$

S – salvage value of asset after n periods

V_0 – purchase price of the asset

D – amount of depreciation amount
apportioned per period

n – number of periods

Declining balance formula

$$S = V_0(1 - r)^n$$

S – salvage value of asset after n periods

r – percentage interest rate per period,
expressed as a decimal

Mean of a sample

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{\sum fx}{\sum f}$$

\bar{x} – mean

x – individual score

n – number of scores

f – frequency

Formula for a z-score

$$z = \frac{x - \bar{x}}{s}$$

s – standard deviation

Gradient of a straight line

$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient-intercept form

$$y = mx + b$$

m – gradient b – y-intercept

Probability of an event

The probability of an event where outcomes
are equally likely is given by:

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$